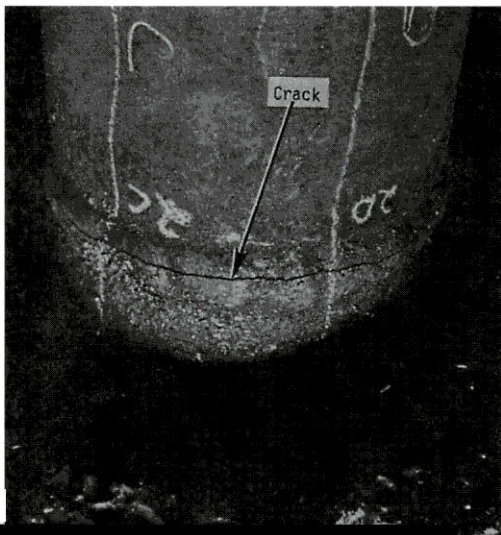


## Spray Attemperators for Industrial Boilers



**Figure 1** Dissimilar material welds can experience cracking in or near the weld.

### Purpose

This plant service bulletin (PSB) advises owners and operators of known superheater attemperator problems and provides recommendations for corrective action.

### Background

The first direct-contact spray attemperator on B&W boilers went into service in the mid-1950s. Most of the attemperators were designed and built by B&W,

although some were supplied by other manufacturers.

PSB-15 was issued in 1985 to notify customers of problems experienced with B&W spray attemperators. However, attemperators built by other manufacturers also have experienced problems on many industrial-sized boilers. This bulletin expands on the information supplied in PSB-15.

### Problem

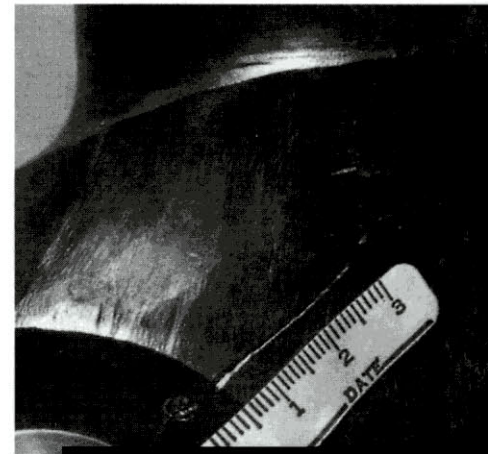
Depending on the operating characteristics of a particular boiler and the extent of load swings it is subjected to, the spray attemperator assembly can experience extensive thermal cycling. Factors contributing to thermal cycling include:

- Temperature differentials between steam and water
- Intermittent (on/off) attemperator operation
- Low-load boiler operation

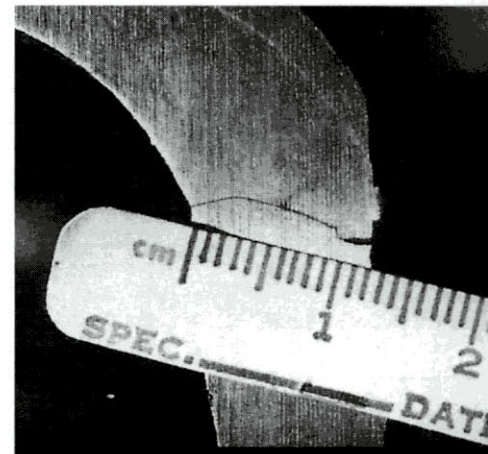
Of the few attemperator failures reported, the cause was mainly attributed to thermal cycling between steam and spray water temperatures. Problems associated with these failures have included:

- Cracks in or near dissimilar material welds (Figure 1)
- Cracks in the older spray nozzle design (Figures 2 and 3)
- Cracks in the attemperator steam line when a liner is not used

- Cracks in the thermal liners which have caused pieces to break off and be carried into the downstream piping
- Spray nozzles that have broken off and become lodged in the venturi or further in the downstream piping

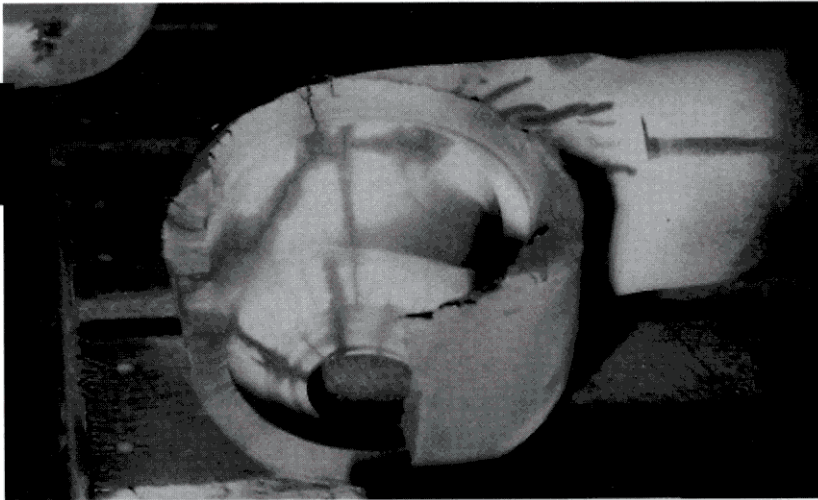


**Figure 2** Crack in an older spray nozzle design.



**Figure 3** Nozzle cracks can occur from extensive thermal cycling between steam and spray water temperatures.

**Figure 4 Failed attemperator spray head.**



### **Warning**

If small parts of the attemperator system break off and are carried downstream, tube plugging may occur and cause localized tube overheating. Larger parts of the spray head also can break loose (Figure 4) and get lodged in the venturi. If this occurs, steam flow is blocked, causing increased pressure drop and uncontrolled steam temperatures. Steam leakage also can result from cracks that have developed in the attemperator body and propagated through the wall.

### **Design improvements for life extension**

To extend attemperator life, B&W has made the following design improvements:

1. A thermal liner was added to the spray attemperator (Figure 5), which protects the high-temperature piping from thermal shock.
2. The spray attemperator material was changed to low-alloy steels, eliminating the need for dissimilar metal welds which can crack (reference Figure 1).

3. One-piece cast spray nozzle heads were designed to eliminate the need for a welded backplate.

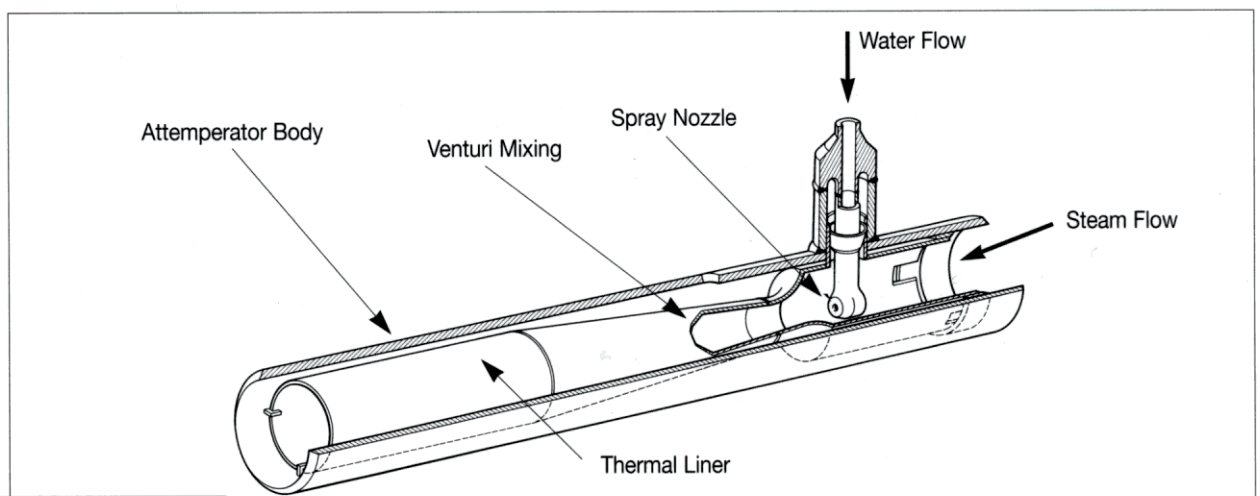
4. Purchasing specifications and quality control procedures were made much more stringent.

### **Inspection recommendations**

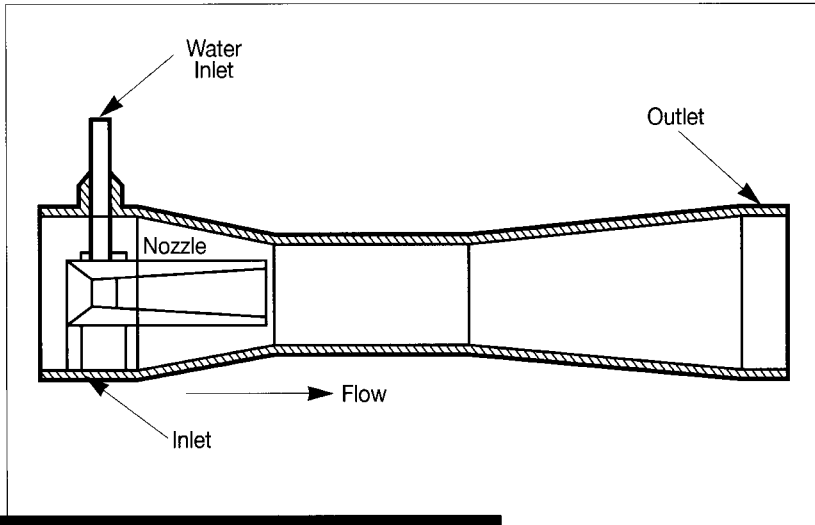
All attemperators with liners should be visually inspected after 10 years of operation. Those without a liner, however, should be inspected after five years of service (Figure 6). Future inspections for all attemperators should be on five-year intervals unless damage is found.

The visual inspection should thoroughly examine the following areas for damage:

- **Spray Nozzle Assembly** (Figure 7) – including the diaphragm, welds on the nozzle extensions (weld #1 and #2), backplate, and the inside and outside of the spray head
- **Attemperator Liner**, if one exists (Figure 8) – including the liner welds (circumferential



**Figure 5 B&W spray attemperator design with a thermal liner.**



**Figure 6 The Graham attemperator design does not have a liner.**

and longitudinal) and the liner retainer block welds

■ **Attemperator Body** – including cracks and erosion, especially when there is not a liner (reference Figure 6)

All areas should be inspected for cracked or broken welds and cracked or broken nozzles, liners and piping. Depending on observations made during the initial inspection, a schedule for subsequent inspections can be determined. The preferred

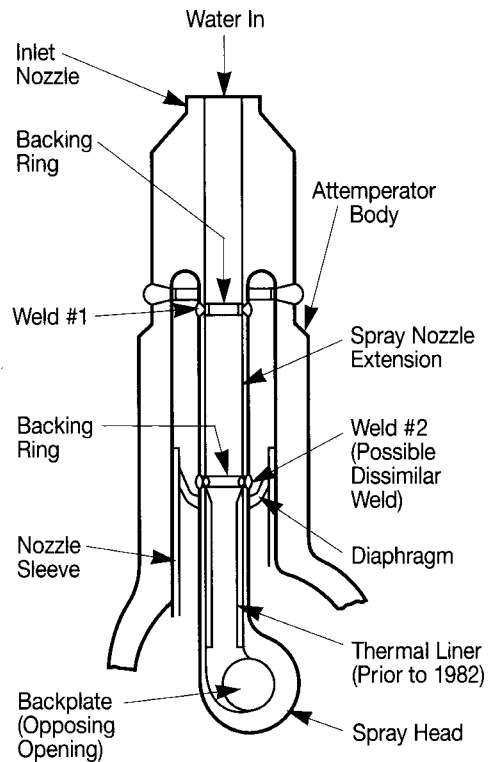
inspection method is to remove the spray nozzle and inspect the venturi and thermal liner using a fiber optic scope or microchip camera. These inspections also can be performed with a fiber optic scope through a radiograph plug or thermowell opening.

The results of the inspection will determine the extent of the repairs. However, if extensive repairs are required, a complete attemperator replacement may be more economical. If a

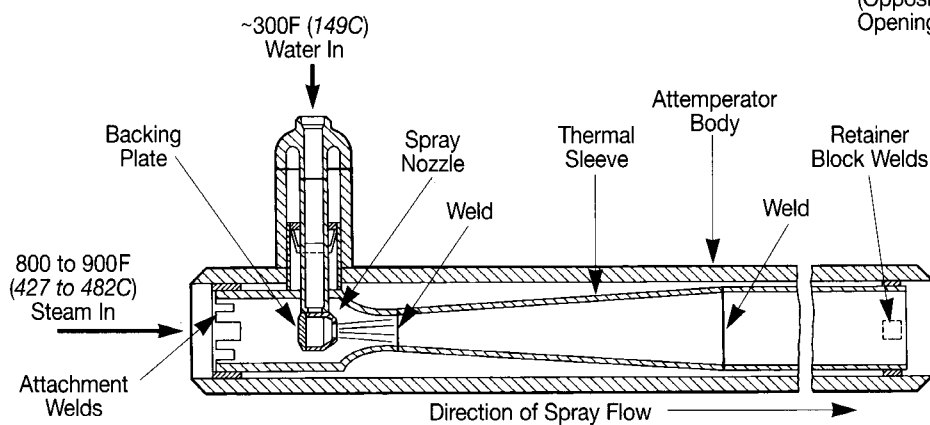
replacement is needed, the attemperator should incorporate B&W's latest design enhancements, which include changing materials to low-alloy steels and adding a thermal liner.

**Support**

Contact Field Service Engineering through your local B&W district service office to coordinate your inspection and repair efforts, and to answer any questions.

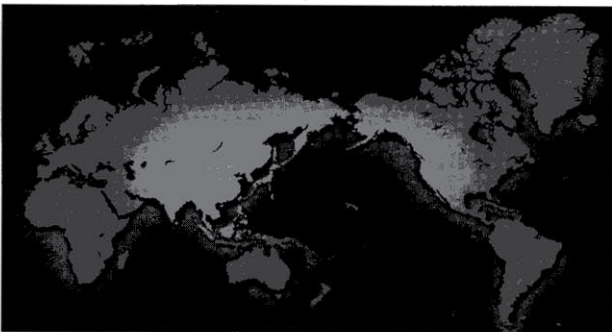


**Figure 7 B&W spray nozzle assembly.**



**Figure 8 Cross section of a typical B&W attemperator assembly.**

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